वर्गीय आवश्यकताओं के लिए मानक

टीईसी २११००:२०२४

STANDARD FOR GENERIC REQUIREMENTS

TEC 21100:2024

छोटे आकार का जीनोडबी

Small Size gNodeB

ISO 9001:2015

दूरसंचार अभियांत्रिकी केंद्र

खुर्शीदलाल भवन, जनपथ, नई दिल्ली-११०००१, भारत

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FOREWORD

Telecommunication Engineering Centre (TEC) functions under Department of Telecommunications (DOT), Government of India. Its activities include:

- Framing of TEC Standards for Generic Requirements for a Product/Equipment, Standards for Interface Requirements for a Product/Equipment, Standards for Service Requirements & Standard document of TEC for Telecom Products and Services;
- Formulation of Essential Requirements (ERs) under Mandatory Testing and Certification of Telecom Equipment (MTCTE);
- Field evaluation of products and Systems;
- Designation of Conformance Assessment Bodies (CABs) for testing.
- Testing & Certification of Telecom products
- Adoption of Standards
- Support to DOT on technology issues;

For the purpose of testing, four Regional Telecom Engineering Centers (RTECs) have been established which are located at New Delhi, Bangalore, Mumbai, and Kolkata.

ABSTRACT

This document is the Standard for Generic Requirements (GR) of the Small Size gNodeB for New Radio (NR) based mobile communication system for deployment in the Indian mobile communication network.
The document specifies Technical Requirements, General Requirements, Features and Functionality of the Small Size gNodeB for NR based mobile communication system.

The document specifies Technical Requirements, General Requirements, Features and Functionality of the gNB System including NSA (Non-Stand Alone) and SA (Stand Alone) deployments.

This GR is applicable for either FDD or TDD or both.

Table of Contents

HISTORY SHEET

S. No.	**Standard / document *No.***	***Title***	***Remarks***
1.	TEC 21100:2024	Standard for Small Size gNodeB	New Standard

REFERENCES

S. NO.	Document No.	Title/ Document Name
1.	TEC 21060:2022	Standard for Generic Requirements of gNodeB
2.	TEC 23090:2023	Standard for Generic Requirements of Compact 5G Mobile System
3.	TEC 25591:2022 (3GPP TS 38.104)	NR; Base Station (BS) radio transmission and reception
4.	TEC 11016:2016	Electromagnetic Compatibility Standard for Telecommunication Equipment
5.	QM-333	Standard For Environmental Testing of Telecommunication Equipment
6.	IP 65	Ingress Protection
7.	IS 13252 Part 1:2010	Information Technology Equipment - Safety, Part 1: General Requirements
8.	IEC 62368-I	Audio/video, information and communication technology equipment - Part 1: Safety requirements
9.	3GPP TS 23.501	System architecture for the 5G System (5GS)
10.	CISPR 32	Limits and methods of measurement of radio disturbance characteristics of information technology equipment
11.	IEC-61000-4-2	Electrostatic discharge immunity test
12.	IEC-61000-4-3	Radiated, radio-frequency, electromagnetic field immunity test
13.	IEC-61000-4-4	Electrical fast transient / burst immunity test
14.	IEC-61000-4-5	Surge immunity test
15.	IEC-61000-4-6	Immunity to conducted disturbances, induced by radio-

		frequency fields
16.	IEC-61000-4-11	AC Power Supply Voltage dips, shot interruptions and voltage variations immunity tests
17.	IEC-61000-4-29	DC Power Supply Voltage dips, shot interruptions and voltage variations immunity tests
18.	ITU-T Q.513	Digital exchange interfaces for operations, administration and maintenance
19.	ITU-T T.50	International Reference Alphabet (IRA) (Formerly International Alphabet No. 5 or IA5) - Information technology - 7-bit coded character set for information interchange
20.	ETSI EN 301 489-17	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services

CHAPTER 1

1. Introduction

1.1. Overview

This document contains the Standard for Generic Requirements (GR) for New Radio (NR) based Small Size gNB for deployment in the Indian mobile communication network. The NGRAN (Next Generation Radio Access Network) consists of gNBs, providing the NR (air interface) user plane (PDCP/RLC/MAC/PHY) and control plane (RRC) protocol terminations towards the UE.

The document specifies Technical Requirements, General Requirements, Features and Functionality of the gNB System including NSA (Non-Stand Alone) and SA (Stand Alone) deployments.

This GR is applicable for either FDD or TDD or both.

1.2. Objective

The key objective of Small Size gNB is to have a compact, cost effective, power efficient and eco-friendly solution, which may address the requirements in terms of coverage, capacity, and quality with ease of deployment and ease of maintenance.

1.3. Applications

As the system is small, compact suitable for providing the 5G mobile communication services, the system may be used for the following applications, as may be required:

i. Private Networks
ii. 5G Mobile Services in remote/ inaccessible areas
iii. Network Offloading
iv. Mobile Networks on Wheels (MNoW)

Small Size gNodeB may be integrated into mobile platforms such as trucks or drones to create rapidly deployable mobile networks. This is particularly useful in emergency situations, disaster recovery, or events where temporary network capacity is needed.

The small size gNodeB is compact, cost effective, power efficient and eco-friendly solution and has the scope of operation in Micro, Pico and other lower cell size scenario. For different requirements in terms of output power, transmitter characteristics and receiver performance for these small cell sizes, 3GPP Specification (TS 38.104) defines the gNB classes for Medium Range Base Station and Local Area Base Station which may be referred to.

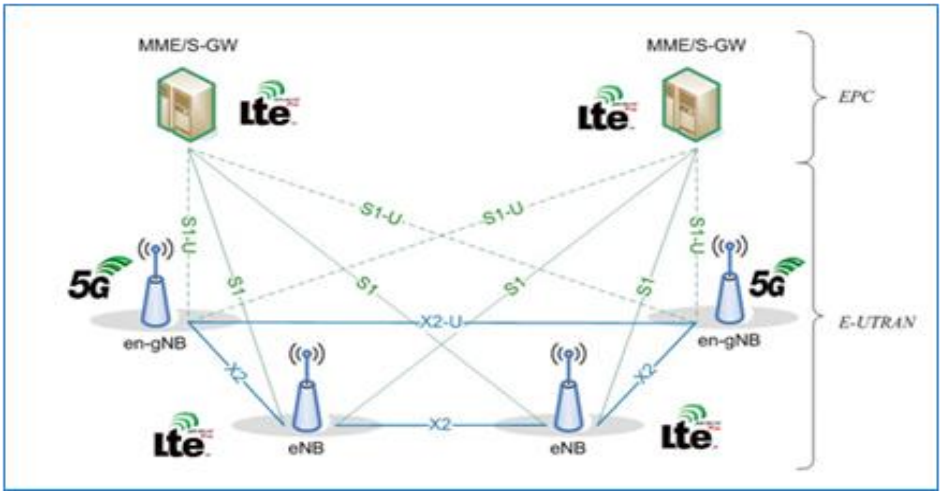
1.4. gNodeB

gNodeB (or gNB in short) is the NG-RAN node in the 5G network architecture that is responsible for radio transmission to and reception from UEs in one or more cells. For NSA, The NG-RAN consists of gNB (serving NR devices using the NR user-plane and control-plane protocols) and ng-eNodeB (serving LTE devices using the LTE user-plane and control-plane protocols), providing the E-UTRA user plane (PDCP/RLC/MAC/PHY) and control plane (RRC) protocol terminations towards the UE. The gNB is connected to the 5G Core network by means of NG interface in standalone mode. The gNBs are also connected by means of the S1 interface to the EPC (Evolved Packet Core) in non-standalone mode. The gNBs may be interconnected with each other by means of the Xn interface in standalone mode and X2 interface in case of non-standalone mode. For SA, The NG-RAN consists of gNB (serving NR devices using the NR user-plane and control plane protocols).

As mentioned above, the NG-RAN can connect not only to a 5G Core Network but also to the EPC (LTE Core Network). As such, the following deployment options have been considered:

a. "Non-Stand Alone" (NSA)

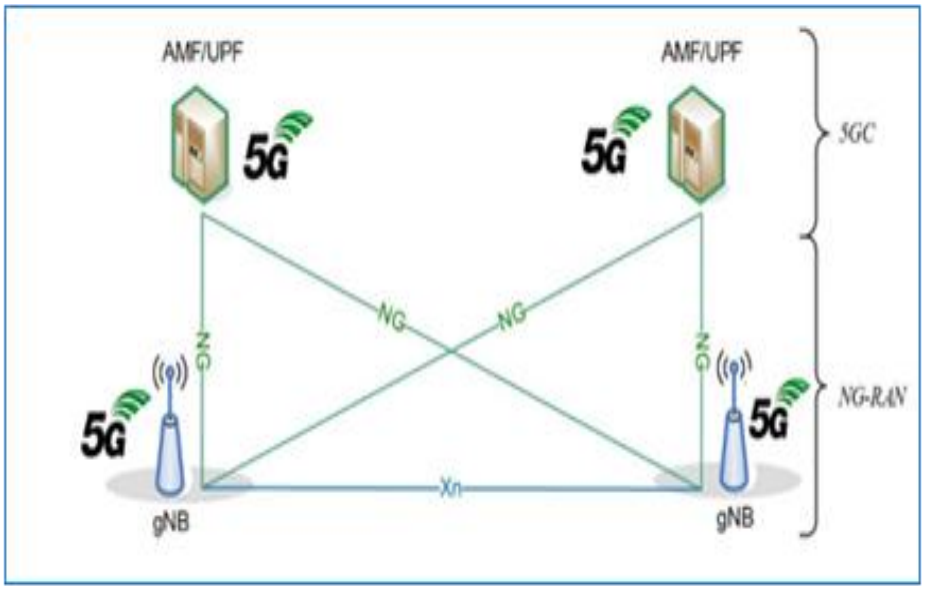
Non-Standalone architecture, where the 5G Radio Access Network (RAN) and its New Radio (NR) interface is used in conjunction with the existing LTE and EPC infrastructure Core Network (respectively 4G Radio and 4G Core). The NSA is also known as "E-UTRA-NR Dual Connectivity (EN-DC)".



The NSA offers dual connectivity, via both the 4G RAN (E-UTRA) and the 5G RAN (NR). It is thus also called "EN-DC", for "E-UTRA and NR Dual Connectivity". In EN-DC, the 4G's eNB is the Master Node (MN) while the 5G's en-gNB is the Secondary Node (SN).

b. "Stand-Alone" (SA)

Standalone architecture, where the NR is connected to the 5G Core Network. The NR base station (logical node "gNB") connects with each other via the Xn interface, and the Access Network (called the "NG-RAN for SA architecture") connects to the 5GC network using the NG interface.



The gNB (or en-gNB) is responsible for all radio-related functions to and from UEs in one or several cells, for example radio resource management, admission control, connection establishment, routing of user-plane data to the UPF and control-plane information to the AMF, and quality-of-service (QoS) flow management. It is important to note that a gNB is a logical node and not a physical implementation.

(Note: One common implementation of a gNB is a three-sector site, where a base station is handling transmissions in three cells, although other implementations can be found as well, such as one baseband processing unit (Consisting of central unit/CU, distributed unit/DU or both) to which several remote radio units (Remote Radio Head/RRH) or Active Array Unit/AAU) are connected.)

The gNB design can be based on a distributed architecture or integrated architecture. This GR defines gNB functionality independent of implementation architecture.

i) Integrated Architecture: Integrated architecture consists of single unit implementing all necessary functions of baseband subsystem and radio subsystem.
ii) Distributed Architecture: The distributed architecture comprised of baseband unit (BBU) collocated with gNB Layer 2, Layer 3 functionality or split into DU and CU functionality and Remote radio head (RRH) connected

via a CPRI/eCPRI or OBSAI interface or another interface. This also covers centralized/cloud RAN (C-RAN)/ vRAN/ O-RAN based architecture.

1.4.1. Functional Requirements

The Small size gNB shall support the following functionalities related to NG-RAN and shall provide the New Radio (NR) air interface user plane (PDCP/ RLC/ MAC/ PHY) and control plane (RRC) protocol terminations towards the User Equipment (UE).

1.4.1.1. Radio Resource Control/ Radio Resource Management (RRC/ RRM)

a) Cell control and AMF support: NG-RAN owns and controls the radio resources of its own cell or cells. Cell resources as requested by and granted to AMF shall be provided in an ordered fashion.
b) RRC messages shall be transmitted to the device using signalling radio bearers (SRBs) including SRB0, SRB1and SRB2.
c) The NG-RAN shall support:
    i. Event-triggered measurement reporting;
    ii. System Information Broadcast (SIB); and
    iii. RRC_IDLE, RRC_CONNECTED, and RRC_INACTIVE states.

1.4.1.2. Service Data Adaptation Protocol (SDAP)

SDAP shall be responsible for mapping Quality-of-Service (QoS) bearers to radio bearers according to their QoS requirements.

1.4.1.3. Packet Data Convergence Protocol (PDCP)

a) The system shall support;
    i. integrity protection and ciphering of RRC signalling;
    ii. RoHC, (As per Procurer requirements)
    iii. data recovery; and
    iv. ciphering of DRBs (As per Procurer requirements)
b) PDCP shall also handle retransmissions, in-sequence delivery, and duplicate removal in the case of handover.

1.4.1.4. Radio Link Control (RLC)

a) RLC shall be responsible for segmentation and retransmission handling. The RLC shall provide services to the PDCP in the form of RLC channels. There shall be one RLC entity per RLC channel (and hence per radio bearer) configured for a device.
b) Segmentation/ Concatenation: RLC layer shall support segmentation and concatenation to adapt the payload to the transport block size.

1.4.1.5. Medium Access Control (MAC)

a) The MAC shall handle multiplexing of logical channels, hybrid-ARQ retransmissions, and dynamic resource allocation (scheduling) and scheduling-related functions.
b) The MAC shall provide services to the RLC in the form of logical channels.
c) From the physical layer, the MAC layer shall use the services in the form of transport channels.
d) Short Buffer Status Report (BSR) and Long BSR
e) Discontinuous Reception (DRX) to enable reasonable UE battery consumption
f) The system shall support:
    i. Link adaptation and power control; and
    ii. Contention based Random Access (RA) procedure.

1.4.1.6. Physical Layer

a) The System Shall Support:
    i. Synchronization Signal Block (SSB).
    ii. Uplink (UL) and downlink (DL) demodulation reference signal.
    iii. UL and DL Link Adaptation.
    iv. UL and DL Power Allocation for data channels.
    v. DL Power setting for data channels.
    vi. DL Power setting for signalling and control channels.
    vii. Normal cyclic prefix.
    viii. At least one Static TDD Mode with single Bandwidth Part.
    ix. Communication of timing advance value to UE.

b) The System shall support following Physical Channel Types:

i. Physical Downlink Shared Channel (PDSCH): Main physical channel used for unicast data transmission, but also for transmission of, for example, paging information, random-access response messages, and delivery of parts of the system information.

ii. Physical Broadcast Channel (PBCH): Carries system information, required by the device to access the network.

iii. Physical Downlink Control Channel (PDCCH): Used for downlink control information, mainly scheduling decisions, required for reception of PDSCH, and for scheduling grants enabling transmission on the PUSCH.

iv. Physical Uplink Shared Channel (PUSCH): The uplink counterpart to the PDSCH. There is at most one PUSCH per uplink component carrier per device.

v. Physical Uplink Control Channel (PUCCH): Used by the device to send hybrid-ARQ acknowledgments, indicating to the NG-RAN whether the downlink transport block(s) was successfully received or not, to send channel-state reports and for requesting resources to transmit uplink data upon.

vi. Physical Random-Access Channel (PRACH): Used for random access. Contention based and Contention free Random Access (CBRA, CFRA) procedure.

c) The System may Support:

i. Following physical layer values for cell carrier bandwidth, sub-carrier spacing and modulation schemes (Procurer can chose as per deployment scenario and applications):

	Low Band (LB) (<1GHz)	Mid Band (MB) (1GHz- 6GHz)	High Band (HB) (24 GHz- 52.5GHz)

Cell carrier bandwidth[1]	5, 10, 15, 20 MHz	5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz	50, 100, 200, 400MHz
Sub-carrier spacing	15 kHz	15kHz, 30 kHz and/ or 60 kHz	60kHz and 120 kHz
Modulation schemes	Up to 256 QAM in downlink and uplink	Up to 256 QAM in downlink and uplink	Up to 64 QAM in downlink and uplink

ii. Both the open-loop power control and the closed-loop power control of the UE. (As per Procurer's requirement)

iii. OFDM modulation in both DL and UL. When DFT-precoding is used, uplink transmissions are restricted to a single layer per UE only while uplink transmissions with multiple layers per UE are possible with OFDM.

iv. DFT-s-OFDM with pi/2 BPSK filtering (LMLC) in Uplink. (As per Procurer requirement)

1.4.1.7. Synchronization

a) The system shall support:
   i. Frequency Synchronization.
   ii. Time and Phase Synchronization.
   iii. At least one of following synchronization option:
      1. GNSS (GPS or NAVIC) (to be specified by procurer)
      2. IEEE 1588 V2
      3. Sync E

b) At least 1 hr hold over mode in case of frequency and phase synchronization loss.

1.4.1.8. MIMO requirements & Modulation Schemes

[1] Subject to valid combinations of SCS, Cell Carrier Bandwidth and cyclic prefix as specified by 3GPP.

(The Procurer may specify specific sub-clauses as well as MIMO configuration, and modulation scheme depending on specific deployment scenario as per their requirements.)

a) The system shall support:

i. SISO, 2X2 MIMO option

ii. up to 4 DL MIMO layers in Low Band

iii. Downlink Single-User MIMO in Mid Band.

iv. Downlink Multi-User MIMO in Mid Band to support minimum 8 layers (As per Procurer requirements)

v. Uplink Multi-User MIMO in Mid Band to support minimum 4-layer UL MU-MIMO for PUSCH transmission (As per Procurer requirements)

vi. DL modulation schemes: QPSK, 16QAM, 64QAM and 256QAM

vii. UL modulation schemes: $\pi/2$-BPSK(As per Procurer requirements), QPSK, 16QAM, 64QAM and 256QAM (Low/ Mid-band)

1.4.1.9. 5G QoS Requirements

a) The System may support:

i. 5QI (5G QoS Identifiers) for NR-Standalone mode as per 3GPP TS 23.501 Table 5.7.4-1.

ii. Multiple data radio bearers (DRBs).

iii. Dynamic addition and deletion of dedicated bearers.

iv. Both UE initiated as well as Network Initiated dedicated bearer creation.

v. Prioritization of traffic in downlink as per the QCI/ 5QI priority value.

1.4.1.10. Mobility Control

a) Idle mode mobility (Re-selection): The system shall support:

i. NR intra-frequency cell re-selection.

ii. NR inter-frequency cell re-selection.

iii. Need to support connected mode mobility control

1.4.1.11. Voice over NR (VoNR)

a) The system may support Voice over NR (VoNR) functionality, including:

i. Basic Voice over NR, which provides traffic functions and protocol procedures for establishing, maintaining, and releasing a voice call in NR;
ii. Voice over NR calls, which allow the handling of voice traffic directly;
iii. Intra frequency handover for voice services; and
iv. IP header compression.
v. Need to include EPS fall-back mechanism since VoNR may not be supported by all the UEs

1.4.1.12. Energy Efficiency & Power Savings

a) The System shall support:
   i. Power saving functionality and shall be power efficient.
   ii. Micro Sleep Transmission, which reduces energy consumption by turning off certain radio hardware components when there is no traffic.
   iii. Low energy scheduler solution (LESS) uses a large amount of resource blocks in the frequency domain to free up space in the time domain. It can help to increase energy efficiency while maintaining the same network performance.
   iv. Discontinuous transmission (DTX) on downlink to save energy during low traffic.
   v. Long cycle Discontinuous Reception (C-DRX).
   vi. Decrease of UE battery consumption by typical traffic patterns and reduces the risk of overheating.
   vii. Automatic enablement/ disablement of the main power amplifier (PA) in the radio-unit. The PA may be turned off in the following cases:
      1. When no PDSCH traffic is scheduled on a subframe; and
      2. During symbols that do not carry mandatory information.

1.4.1.13. Uu Interface

a) The system shall support Uu interface towards the user equipment/ device (UE).

1.4.1.14. Operating Frequency & Channel bandwidth

a) Operating frequency and Channel bandwidth shall be as per the applicable National Frequency Allocation Plan.

b) The system shall be capable of operating in at least one of the frequency bands as per the applicable National Frequency Allocation Plan.

1.4.1.15. Transmitter Specification (Conducted)

S. No.	Parameter Name	Standard (TEC/ 3GPP)
01	Base station output power	TEC 25591:2022 (3GPP TS 38.104) Clause 6.2
02	RE Power control dynamic range	TEC 25591:2022 (3GPP TS 38.104) Clause 6.3.2
03	Total Power dynamic range	TEC 25591:2022 (3GPP TS 38.104) Clause 6.3.3
04	Transmitter OFF power	TEC 25591:2022 (3GPP TS 38.104) Clause 6.4
05	Frequency Error	TEC 25591:2022 (3GPP TS 38.104) Clause 6.5.1
06	Error Vector Magnitude	TEC 25591:2022 (3GPP TS 38.104) Clause 6.5.2
07	Time alignment error	TEC 25591:2022 (3GPP TS 38.104) Clause 6.5.3
08	Occupied Bandwidth	TEC 25591:2022 (3GPP TS 38.104) Clause 6.6.2

09	Adjacent Channel Leakage Power Ratio (ACLR)	TEC 25591:2022 (3GPP TS 38.104) Clause 6.6.3
10	Operating band unwanted emissions	TEC 25591:2022 (3GPP TS 38.104) Clause 6.6.4
11	Transmitter spurious emissions	TEC 25591:2022 (3GPP TS 38.104) Clause 6.6.5
12	Transmitter Intermodulation	TEC 25591:2022 (3GPP TS 38.104) Clause 6.7

1.4.1.16. Transmitter Specification (Radiated)

S. No.	Parameter Name	Standard (TEC/ 3GPP)
01	OTA Base Station Output Power	TEC 25591:2022 (3GPP TS 38.104) Clause 9.3
02	OTA RE power control dynamic range	TEC 25591:2022 (3GPP TS 38.104) Clause 9.4.2
03	OTA Total power dynamic range	TEC 25591:2022 (3GPP TS 38.104) Clause 9.4.3
04	OTA Transmitter OFF Power	TEC 25591:2022 (3GPP TS 38.104) Clause 9.5
05	OTA Frequency Error	TEC 25591:2022 (3GPP TS 38.104) Clause 9.6.1

06	Error Vector Magnitude	TEC 25591:2022 (3GPP TS 38.104) Clause 9.6.2
07	OTA Time alignment Error	TEC 25591:2022 (3GPP TS 38.104) Clause 9.6.3
08	OTA Occupied Bandwidth	TEC 25591:2022 (3GPP TS 38.104) Clause 9.7.2
09	OTA Adjacent Channel Leakage Power Ratio (ACLR)	TEC 25591:2022 (3GPP TS 38.104) Clause 9.7.3
10	OTA Operating band unwanted emissions	TEC 25591:2022 (3GPP TS 38.104) Clause 9.7.4
11	OTA Transmitter Spurious Emission	TEC 25591:2022 (3GPP TS 38.104) Clause 9.7.5

1.4.1.17. Receiver Specification (Conducted)

S. No.	Parameter Name	Standard (TEC/ 3GPP)
01	Receiver Spurious emissions	TEC 25591:2022 (3GPP TS 38.104) Clause 7.6
02	Blocking	TEC 25591:2022 (3GPP TS 38.104) Clause 7.4.2 & 7.5
03	Receiver intermodulation	TEC 25591:2022 (3GPP TS 38.104) Clause 7.7

04	Adjacent Channel Selectivity (ACS) and narrow-band blocking	TEC 25591:2022 (3GPP TS 38.104) Clause 7.4.1
05	Dynamic Range	TEC 25591:2022 (3GPP TS 38.104) Clause 7.3
06	In-channel selectivity	TEC 25591:2022 (3GPP TS 38.104) Clause 7.8
07	Reference sensitivity level	TEC 25591:2022 (3GPP TS 38.104) Clause 7.2

1.4.1.18. Receiver Specification (Radiated)

S. No.	Parameter Name	Standard (TEC/ 3GPP)
01	OTA Receiver Spurious Emissions	TEC 25591:2022 (3GPP TS 38.104) Clause 10.7
02	OTA Blocking	TEC 25591:2022 (3GPP TS 38.104) Clause 10.5.2 & 10.6
03	OTA Receiver Intermodulation	TEC 25591:2022 (3GPP TS 38.104) Clause 10.8
04	OTA Adjacent channel selectivity	TEC 25591:2022 (3GPP TS 38.104) Clause 10.5.1
05	OTA Dynamic Range	TEC 25591:2022 (3GPP TS 38.104) Clause 10.4

06	OTA In- Channel Selectivity	TEC 25591:2022 (3GPP TS 38.104) Clause 10.9
07	OTA Reference sensitivity level	TEC 25591:2022 (3GPP TS 38.104) Clause 10.3

1.5. Operational, Reliability, Quality, EMI/ EMC, Safety Requirements

1.5.1. System Radio Operating Environments

1.5.1.2 System Supervision

a) Provision shall be made for continuous testing of the system to allow both system qualities check and fault indication as a fault arises.
b) In case a fault is detected requiring reloading of the program, this shall be carried out automatically. In case of manual re-loading, it shall be possible to stop and start at any particular point in the program

1.5.1.2 Relative UE speed

The targeted relative speed between the gNB and the mobile stations may be chosen from the following categories: (Applicable for Low/Mid band)

a. Stationary (0 km/h)
b. Pedestrian (up to 10 km/h)
c. Vehicular: 10 km/h to 120 km/h (As per Procurer requirements)
d. High speed vehicular: 120 km/h to 500 km/h (As per Procurer requirements)

For High band, the targeted relative speed between the gNB and the mobile station may be up to 100 km/h. (As per Procurer requirements)

1.5.2. System and Network Managements

a. Facility shall be available for introduction of centralized maintenance control (OMC).

b. The maintenance spares supplied shall take into account the MTBF and MTTR

1.5.3. Diagnostic Capability

a. The diagnostic capability of the system shall be such as to minimize the human efforts required. The diagnostic programs which are normally resident in the on-line program shall be indicated. Details of the off-line diagnostic programs shall be given. The procedure for invoking such programs shall be described. The procedure for consulting fault dictionary for diagnostic programs shall be made available.
b. The system shall provide facility for automatic restart under severe fault conditions. Where automatic restart fails to restore system sanity, facility shall be provided for manual restart of the system.

1.5.4. Environmental Test Conditions:

a. Indoor gNB / Indoor BBU: Category A SD: QM-333
b. Outdoor gNB BBU & RRH: Category D SD: QM-333 and IP65
c. Antenna & Feeders: Category E as per SD: QM-333

1.5.5. Qualitative Requirements (QR)

a. The supplier/manufacturer shall conform to ISO 9001:2015 certifications. A quality plan describing the quality assurance system followed by the manufacturer shall be required to be submitted.
b. For a distributed gNB, the failure of any component/ sub-system in the system shall not result in the failure of complete system.

1.5.6. gNB Safety Requirements

Clause	Parameter	Standard
1.	The equipment shall conform to IS 13252 part 1:2010- “Information Technology	IS 13252 part 1:2010;

	Equipment – Safety- Part 1: General Requirements” OR IEC 62368-I:2023 – “Audio/video, information and communication technology equipment - Part 1: Safety requirements”	OR IEC 62368-I:2023

1.5.7. gNB Electromagnetic Compatibility (EMC)

(These requirements shall be as per TEC Standard No. TEC11016:2016 as modified/ amended from time to time)

Clause	**Parameter**	**Standard**
1.	Conducted and Radiated Emission	CISPR 32 Class-A
2.	Immunity to Electrostatic discharge: Contact discharge level 2 {± 4 kV}	IEC-61000-4-2 Performance Criteria-B, Clause 9
3.	Immunity to Electrostatic discharge: Air discharge level 3 {± 8 kV}	IEC-61000-4-2 Performance Criteria-B, Clause 9
4.	Immunity to radiated RF: a) Radio Frequency: 80 MHz to 1 GHz, Electromagnetic field: 3V/m b) Radio Frequency: 800 MHz to 960 MHz, Electromagnetic field: 10V/m c) Radio Frequency: 1.4 GHz to 6 GHz, Electromagnetic field: 10V/m	IEC 61000-4-3 (2010); Performance Criteria-A, Clause 9 ***Note*** *- In the case of small size gNodeB with Wi-Fi interface, the exclusion bands for Immunity to radiated RF testing needs to be considered as per clauses (4.3.2) and (4.3.3 & 4.3.4) of ETSI EN 301 489-17 standard for WLAN*

		operation in 2.4 GHz band 5 GHz bands respectively with exception that exclusion bands will not be applicable for testing of transmitters in standby mode or receivers or receiver part of transceivers.
5.	Immunity to fast transients (burst): Test Level 2: a) 1 kV for AC/DC power port b) 0. 5 kV for signal / control / data / telecom lines.	IEC 61000- 4- 4 {2012); Performance Criteria-B, Clause 9
6.	Immunity to surges: AC/DC ports a) 2 kV peak open circuit voltage for line to ground b) 1kV peak open circuit voltage for line to line	IEC 61000-4-5 (2014) Performance Criteria-B, Clause 9
7.	Immunity to surges: Telecom ports a) 2 kV peak open circuit voltage for line to ground coupling. b) 2 kV peak open circuit voltage for line-to-line coupling.	IEC 61000-4-5 (2014) Performance Criteria-C, Clause 9
8.	Immunity to conducted disturbance induced by Radio frequency fields: Under the test level 2 {3 V r.m.s.} in the frequency range 150 kHz-80 MHz for AC / DC lines and Signal /Control/telecom lines.	IEC 61000-4-6 (2013) Performance Criteria-A, Clause 9
9.	Immunity to voltage dips & short interruptions (applicable to only ac mains power input ports, if any):	IEC 61000-4-11 (2004): a) Performance Criteria B for Reduction of Supply 30% for

	Limits: - a) a voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms (i.e., 70% supply voltage for 500ms) b) a voltage dip corresponding to a reduction of the supply voltage of 60% for 200ms; (i.e.,40% supply voltage for 200ms) c) a voltage interruption corresponding to a reduction of supply voltage of > 95% for 5s. d) a voltage interruption corresponding to a reduction of supply voltage of >95% for 10ms.	500ms or Dip to reduction of 60% for 100ms b) Performance Criteria C for Reduction of 60% for 200ms c) Performance criteria C for Voltage Interruption>95% for 5 s (Note: In case of Battery back-up performance criteria A is applicable). d) Performance Criteria B for Voltage Interruption >95% duration :10ms (Note: In case of Battery back-up Performance Criteria A is applicable for above conditions.)
10.	Immunity to voltage dips & short interruptions (applicable to only DC power input ports, if any): a) Voltage Interruption with 0% of supply for 10ms. b) Voltage Interruption with 0% of supply for 30ms, 100ms, 300ms and 1000ms. c) Voltage dip corresponding to 40% & 70% of supply for 10ms, 30 ms. d) Voltage dip corresponding to 40% & 70% of supply for 100ms, 300 ms and 1000 ms.	IEC 61000-4-29(2000) a) Applicable Performance Criteria shall be B. b) Applicable Performance Criteria shall be C. c) Applicable Performance Criteria shall be B. d) Applicable Performance Criteria shall be C. e) Applicable Performance Criteria shall be B.

	e) Voltage variations corresponding to 80% and 120%of supply for 100 ms to 10s as per Table 1c of IEC 61000-4-29.	

General Requirements

1.6.1 General

a. 5G provides users a facility for high-speed data & voice. The system shall have facilities for automatic roaming, locating and updating mobile subscribers.

b. The operation of the equipment shall be in the frequency band allotted.

1.6.2 Support of Multiple Equipment Vendors as per tender requirement

a. The system shall support the possibility of using equipment and sub-systems of different vendors as per defined industry standards, wherever relevant.

1.6.3 Hardware

a. The system hardware shall be modular in design and shall permit growth in steps. The arrangement shall be such that failure/ deterioration of service shall not occur when implementing the growth.

b. Design precautions shall be taken to minimize the possibility of equipment damage arising from the insertion of an electronic package into the wrong connector or the removal of any package from any connector.

c. The system hardware shall not pose any problem, due to changes in date and time caused by events such as changeover of leap year etc., in the normal functioning of the system.

1.6.4 Processors

a. Provision shall be made to prevent the loss/alteration of memory contents due to power failures, improper operating procedures and the procedure for restoring the system to its normal state, etc.

1.6.5 Input-Output devices

a. The communication facilities provided for exchange of information between the elements of 5G-RAN and the maintenance and operating personnel shall include facilities for a system test, control and alarm indication at OMC.

b. Input / output terminals shall be capable of transmitting/ receiving characters of a subset of the ITU-T T.50 alphabet. The printing/display device shall print/display different graphic symbols for the digit zero and the capital letter O. The input/output terminal shall have the English Keyboard.

c. Adequate number of man-machine interfaces shall be available.

d. If provision is made for monitoring from a remote terminal, it shall be ensured that the data links conform to the ITU-T Recommendation Q.513. Care shall be taken that the reliability of the data links towards remote terminal does not, in any way, affect the reliability of the 5G-RAN. Special provision shall also be made for storage of failure event even when the system is unable to transmit an output message.

e. A suitable alarm and display system at OMC shall be provided for a continuous indication of the system status.

1.6.6 Equipment Practice

a. For a Distributed gNB, suitable test access points and displays shall be provided for facilitating maintenance. Test access points shall be located on the front side of the bay. All visual display devices shall be located in a position attracting immediate attention of the operation and maintenance personnel.

b. For a Distributed gNB, it shall be indicated whether printed board connectors are of edge-type or plug-and-socket type. They shall not be easily damaged during replacements and removals. The contact particulars as well as life test performance on contact resistance for each type of connector shall be supplied.

c. All components and material used in the equipment shall be non-inflammable or in absence of it, self-extinguishable. They shall be fully tropicalised.

d. For a Distributed gNB, the method used for connection of permanent wiring outside the printed cards shall be indicated.
e. The buses, if any, shall be suitably protected against electrical and magnetic interference from neighbouring systems (like electromechanical systems, fluorescent tubes, motors, etc.).
f. For a Distributed gNB, the different plug-in cards shall have suitable mechanical safeguards to prevent damage due to accidental interchange of cards.
g. The requirement at the external interface against induced voltages and currents due to lightning, high power system, etc. shall be indicated.
h. The system shall provide for human isolation and protection from accidental high voltage power contact.

1.6.7 Quality Requirements

a. The components used shall be available from multiple sources with adequate qualification. Number of proprietary components used shall be minimum. List of such components shall be indicated.
b. All the equipment shall have a tropical finish and coated to protect against saline atmosphere.

1.6.8 Software

a. The software shall be written in a High-Level Language. The software shall be modular and structured.
b. The software shall include the following characteristics:
    i. The design of the software shall be such that the system is easy to handle both during installation and normal operations as well as during extensions.
    ii. The functional modularity of the software shall permit introduction of changes wherever necessary with least impact on other modules.
    iii. It shall be open-ended to allow addition of new features.
    iv. Adequate flexibility shall be available to easily adopt changes in service features & facilities and technological evolution in hardware.

v. The design shall be such that propagation of software faults is contained.

vi. Test programs shall include fault tracing for detection and localization of system faults.

1.6.9 Software Maintenance

a. All software updates, for a period as specified, shall be supplied on continuing basis. These updates shall include new features and services and other maintenance updates.

b. Integration of software updates without posing any problem to the existing functionality shall be possible.

1.6.10 gNB DoS (Denial of Service) Attack Protection

a. The gNB shall provide the protection against DOS attack. The vendor shall describe how to protect against DOS attack in their system.

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CHAPTER 2

2. INFORMATION FOR THE PROCURER OF PRODUCT

In the document, some features needs to be examined by the procurer and suitably specified in the tender conditions as per their requirement based on the deployment scenario specific to the procurer.

Abbreviations

For the purpose of this document the following abbreviations apply:

2CC	Two Carrier Aggregation
3CC	Three Carrier Aggregation
5GC	5G Core
AAS	Active Antenna System
ACLR	Adjacent Channel Leakage Ratio
ACS	Adjacent Channel Selectivity
AMF	Access and Mobility Management Function
ARQ	Automatic Repeat Request
BPSK	Binary phase-shift keying
BS	Base Station
BW	Bandwidth
CA	Carrier Aggregation
CU	Centralized Unit
CN	Core Network
CPRI	Common Public Radio Interface
C-DRX	Connected Mode Discontinuous Reception
DU	Distributed Unit
DOS	Denial of Service
DFT	Discrete Fourier Transformation
DL	Downlink
DFT	Discrete Fourier transform

eCPRI	Enhanced CPRI
en-gNB	gNB that can connect with EPC
EN-DC	E-UTRAN New Radio – Dual Connectivity
EPC	Evolved Packet Core
EMS	Element Management System
EVM	Error Vector Magnitude
F1-C	F1 Interface Control Plane
F1-U	F1 Interface User Plane
FDD	Frequency Division Duplex
GPS	Global Positioning System
HB	High Band
ICS	In-Channel Selectivity
IMS	IP Multimedia Subsystem
IOT	Internet Of Things
LTE	Long Term Evolution
LMLC	Low Mobility Large Cell
LB	Low Band
MAC	Medium Access Control
MB	Mid Band
MIMO	Multiple Input Multiple Output
MME	Mobility Management Entity
MTBF	Mean Time Between Failure
MTTR	Mean Time To Repair
NB-IOT	Narrow Band IOT

NR	New Radio
NSA	Non-Standalone
OBSAI	Open Base Station Architecture Initiative
OMC	Operations and Maintenance Controller
OTA	Over the Air
OFDM	Orthogonal frequency-division multiplexing
PDCCH	Physical Downlink Control Channel
PDSCH	Physical Downlink Shared Channel
PDCP	Packet Data Convergence Protocol
PHY	Physical Layer
PUSCH	Physical Uplink Shared Channel
PUCCH	Physical Uplink Control Channel
PWS	Public Warning System
QAM	Quadrature Amplitude Modulation
QCI	QoS Class Identifier
QOS	Quality of Service
QPSK	Quadrature Phase-Shift Keying
RAN	Radio Access Network
RAT	Radio Access Technology
RF	Radio Frequency
RMS	Root Mean Square (value)
RRH	Remote Radio Head
RS	Reference Symbol
RX	Receiver
RLC	Radio Link Control

RRC	Radio Resource Control
SA	Standalone
SNMP	Simple Network Management Protocol
SCS	Subcarrier Spacing
SDAP	Service Data Adaption Protocol
SON	Self-organizing networks
SSB	Synchronization Signal Block
S-NSSAI	Single Network Slice Selection Assistance Information
TA	Timing Advance
TDD	Time Division Duplex
TX	Transmitter
UE	User Equipment
UPF	User Plane Function
UL	Uplink
VLAN	Virtual Local Area Network
VoNR	Voice over NR
ViNR	Video over NR

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